

Sales Guide

August 2003



IBM @server 325

Product Overview

Groundbreaking 32/64-bit performance in a 1U server

[Target Customers: Businesses requiring a High-Performance Computing server with 32-bit (and, optionally, 64-bit) capabilities in a space-constrained data center, or Scientific/Technical computing clusters.]

In today's world, replacing hardware is expensive. The challenge for your customers is to stretch their IT dollars as far as possible. The **2-way IBM @server 325** lets them do exactly that by offering affordable 32-bit computing today with growth to 64-bit computing when needed. It supports the latest AMD Opteron processors with HyperTransport technology. HyperTransport technology is a high-speed, point-to-point link between the processor and the memory, graphics and I/O controllers that provides outstanding performance by bypassing many key bottlenecks that afflict other processor architectures. Opteron is capable of running both 32-bit and 64-bit software with blazing performance. This provides customers with the flexibility to start with 32-bit applications and grow to 64-bit software over time, without having to replace their servers to do so. In fact, using a 64-bit operating system, both 32-bit and 64-bit applications can be run concurrently.

In addition, the e325 uses leading-edge industry-standard **ECC** (Error Checking and Correcting) **PC2700 333MHz** double data rate (DDR) memory with **Chipkill™** technology—for high performance and reliability. **Dual integrated Gigabit Ethernet¹** controllers are standard, providing high-speed data transfers and saving valuable adapter slots.

All models offer impressive scalability for a **1U** server, including dual-processor support, up to **12GB** of memory and **two** high-performance hard disk drives with an internal storage capacity of up to **293.6GB²** (hot-swap SCSI) or **240GB** (fixed IDE). The built-in SCSI controller supports **RAID-1** mirroring. Additional RAID support is available via the optional IBM ServeRAID™ family of Ultra160 and Ultra320 SCSI controllers. The ultradense 1U form factor allows businesses to increase their computing power and spread their workload without outgrowing their current data center. Up to **42** of these servers can be installed in a single 42U rack, for a total of up to **84** processors, offering your customers tremendous deployment flexibility. Optional Advanced Connectivity Technology (ACT) interconnect cabling technology minimizes cable clutter, reduces cable cost and minimizes installation time when cabling many e325 servers in a single rack.

Standard in the e325 is an integrated systems management controller, optimized for HPC cluster manageability, that enables the user to manage and control the server easily—both locally and remotely. These advanced features help maximize application availability by increasing server uptime, as do hot-swap redundant HDDs and variable speed fans.

With the inclusion of unique manageability features, such as **IBM Director** and support for the optional **IBM Remote Supervisor Adapter II** (both planned for Q4/03) the e325 is designed for superior uptime. In addition, **IBM Cluster Systems Management** can help to reduce the total cost of ownership for cluster environments by streamlining and simplifying the management of large numbers of servers from a single point of control.

If your customer needs leading-edge 32-bit performance in a 1U rack-optimized package, with the added power of 64-bit computing, at a much lower cost than Itanium 2 servers currently offer—and *without* replacing hardware, the e325 is the ideal system. To illustrate, in the **SPECfp_rate2000** benchmark³, the e325 (in a dual AMD Opteron 246 processor configuration)

CONTENTS

Product Overview	1
Key Features	2
Key Options	7
e325 Images	8
e325 Specifications	9
Selling Features	11
Easy Configurator	12
Product Positioning	14
Competitive Analysis	14
For More Information	18
Legal Information	18

¹ Actual data transfer speed will vary and is often less than the maximum possible. Gigabit Ethernet transfer speed requires support on both system and server, and appropriate network infrastructure.

² GB equals 1,000,000,000 bytes when referring to hard disk drive capacity. Accessible capacity may be less.

³ HP DL360 results: <http://www.spec.org/cpu2000/results/res2003q3/cpu2000-20030630-02353.html>; HP rx2600 results: <http://www.spec.org/cpu2000/results/res2003q3/cpu2000-20030630-02322.html>; IBM @server 325 results will be available as of

Key Features

posted a floating-point score that was **41% better** than that of the Xeon-based HP DL360 G3 server, and at a slightly lower cost. The same e325 score was **63%** of that posted by the Itanium 2-based HP rx2600 server, but at **one-seventh the cost!**

In short: Compared to the x335, the e325 is **faster** (faster processor for integer operations, faster DDR memory), has **greater memory capacity**, and it offers the ability to **run both 32-bit and 64-bit** applications concurrently. When running a 64-bit operating system, the e325 breaks through the “4GB barrier” for memory addressing imposed by 32-bit processors.

What’s New? (Compared to the x335)

- AMD Opteron processors with HyperTransport technology, integrated memory controller and **1MB** of L2 processor cache
- **PC2700 333MHz DDR Chipkill ECC** memory (vs. PC2100 266MHz DDR Chipkill ECC memory for the x335)
- **12GB** memory capacity (vs. 8MB for the x335)
- **Four** USB 1.1 ports (2 front, 2 rear)
- Optional USB floppy drive

High-Performance Opteron Processors

The e325 offers a choice of processors:

- AMD Opteron 240, 242 and 246



The integrated memory controller and **1MB** of L2 cache run at the full processor clock rate, not the stepped down rate of the front-side bus (FSB) used in Intel processors. Because of this, the **Opteron 246's** Hyper Transport Tunnel offers peak throughput of **16.0GB per second** vs. only **6.4GBps** for the (1.5GHz) **Itanium's** front-side bus (FSB) — up to **250%** faster than Itanium 2, and a maximum of **4.26GBps** for the (3.06GHz) **Xeon's** FSB (up to **375%** faster than Xeon). Similarly, the maximum aggregate peak memory throughput of the Opteron in a 2-way configuration is **10.6GBps**, or up to **250%** higher throughput than the peak rate of **4.26GBps** provided by the 533MHz FSB of the Intel Xeon processor used in the x335, and up to **24%** more than the **8.5GBps** of the Itanium 2. I/O performance is equally strong, with the Opteron supporting a peak I/O bandwidth of **12.8GBps**, or up to **50%** more than the Itanium's **6.4GBps maximum**, and up to **400%** of the **3.2GBps** of the Xeon.

The e325 ships with one processor, upgradable to two.



DDR Chipkill ECC Memory

The e325 supports up to **12GB⁴** of memory in **six** DIMM sockets. It uses registered **PC2700** double data rate (DDR) two-way interleaved memory (operating at **333MHz**) for faster access, and incorporates the same renowned **IBM Chipkill** ECC technology used in more expensive IBM servers, for **up to 16X** better error correction than standard ECC memory.

Memory must be installed in pairs. It is available in 512MB and 1GB (2GB DIMMs are planned).

Large Disk Storage Capacity

The e325 offers a choice of disk storage, supporting up to **two** internal HDDs:

Hot-swap SCSI

- **Ultra320**, 10,000 RPMs — 36.4, 73.4 or **146.8GB (293.6GB maximum)**
- **Ultra320**, 15,000 RPMs — 36.4 or **73.4GB (146.8GB)**

Fixed IDE (ATA-100)

- **7,200 RPM** — 40, 60, 80 or **120GB (240GB)**



The SCSI drives are hot-swappable, while the IDE drives are not. If the customer needs more storage space, terabyte capacities are possible with external IBM ServeRAID SCSI or IBM FASTT Fibre Channel storage solutions. The Ultra320 SCSI hot-swap drives use the Converged Tray for interchangeability with xSeries systems and FASTT expansion units.

August 11, 2003. Price comparisons using public web prices as of July 28, 2003.

⁴ In a 2-way configuration, using 2GB DIMMs. See the e325 system specifications table for details.

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Ultra320 SCSI Controller



The integrated single-channel **Ultra320 SCSI** controller (**LSI 53C1020**) allows speeds of up to 320MB per second⁵ across the SCSI bus and supports two internal Ultra320 or Ultra160 SCSI LVD (low-voltage differential) drives with selectable **RAID-1** disk mirroring.

Optional IBM ServeRAID controllers increase the RAID support to *nine* different levels. For low-cost RAID support of internal *IDE* drives, use the ATA-133 RAID Controller. Supported RAID controllers include:

- **ServeRAID-6M — Ultra320**, 2-channel, **256MB** battery-backed cache, **133MHz PCI-X**
- **ServeRAID-6M — Ultra320**, 2-channel, 128MB battery-backed cache, **133MHz PCI-X**
- **ServeRAID-4Lx — Ultra160**, 1-channel, 32MB cache, 66MHz PCI
- **ATA-133 RAID Controller (IDE)** — ATA-133, ATA-100, ATA-66, 2-channel, half-length

The **ServeRAID-4** and **ServeRAID-6M** controllers support external SCSI expansion via the **IBM EXP300** Storage Expansion Unit. Each EXP300 adds up to **2.055TB** of external Ultra160 SCSI storage capacity.

The RAID subsystem is closely linked with IBM Director to allow proactive monitoring of the disk subsystem. This feature is used to generate alerts in the event of an impending disk failure or an actual disk failure via Predictive Failure Analysis® (PFA).

Dual-Channel Gigabit Ethernet Controller

The e325 includes a two-channel integrated **Broadcom BCM5704** Gigabit Ethernet controller for up to 10X higher maximum throughput than the dual 10/100 Ethernet controllers used in some systems. Having integrated controllers saves PCI slots. Optional PCI adapters offering failover and load balancing between them are available for better throughput and system availability.

64-bit High-Speed PCI-X Adapter Slots



The e325 has **one full-length** and **one half-length** adapter slot, capable of supporting 100MHz 64-bit and 32-bit PCI-X adapters and/or older 64-bit and 32-bit 66MHz and 33MHz PCI adapters. Because the Ultra320 SCSI, dual Gigabit Ethernet and systems management controllers are integrated onto the system board, the two available high-speed adapter slots offer customers a wide degree of latitude in expansion options.



Other New Features

- **Four USB 1.1 ports** — The flexibility to add more external devices, with two ports in the front and two in the rear.
- **High-resolution video** — Up to 1600x1200 resolution, with a color depth of 24 bits at 85Hz refresh rate, using the ATI Rage XL SVGA video controller.
- **USB-attached floppy drive support** — Optional drive can be relocated to share among multiple systems.
- **Toolless features** — No tools are required for rack installation, cover removal, adapter retention, power supply replacement or HDD installation/removal.

What's Hot?



- **Dual processor** capability providing symmetrical multiprocessing (SMP) with **HyperTransport technology** and integrated memory controller
- **Systems management** capabilities appropriate for the HPC environment
- Extensive **systems management and support** features

Dual SMP Processors with HyperTransport Technology

The e325 supports up to two high-performance AMD Opteron processors, allowing customers to upgrade to a second processor as business needs require.

HyperTransport technology is a high-speed, low-latency, point-to-point link, designed to increase the communication speed between circuits. It eliminates a key bottleneck currently caused by the

⁵ Data transfer rates depend on many factors and are often less than the maximum possible.

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stepped-down front side bus (FSB) used in other system architectures, by accessing memory at the same speed as the processor. This permits the fastest possible access to CPU and memory.

Opteron offers outstanding 32-bit performance using today's operating systems, and an upgrade path to low-cost 64-bit computing with tomorrow's 64-bit OSes. With a 64-bit OS, Opteron is even capable of running both 64-bit and 32-bit applications concurrently.

Go to <http://amd.com> for more information on HyperTransport technology.

Rack Cable Management and KVM Console Switching

IBM Advanced Connectivity Technology (ACT) is an optional feature that offers many of the same advantages as IBM C2T™ Interconnect cabling (used with x330/x335 servers), plus a few others, across the entire xSeries product line. So now customers can interconnect all of their xSeries and Netfinity servers with one smart cabling architecture. Like C2T Interconnect technology, ACT cabling eliminates the need for one-to-one direct connections between each server and a KVM switch.



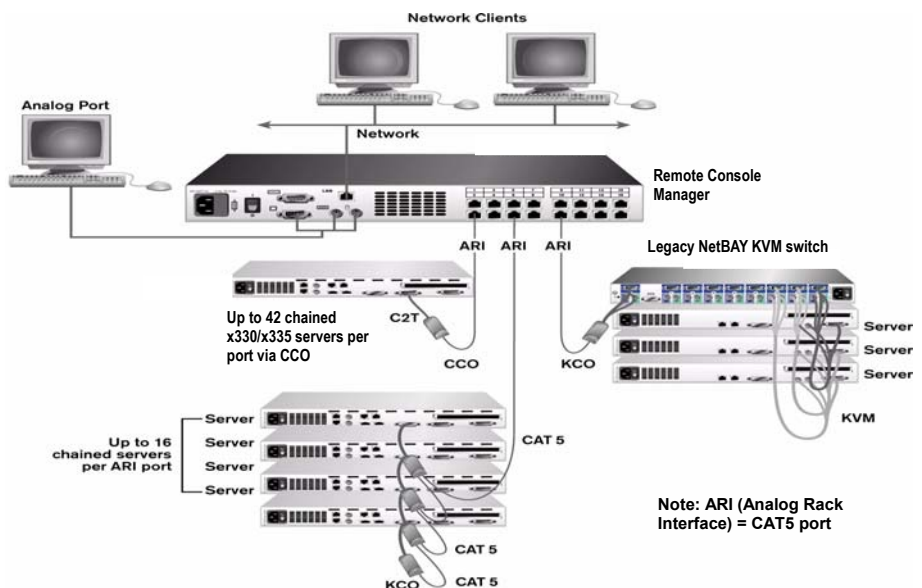
Short KCO

Here's how it works: A USB Conversion Option (UCO) plugs into a USB port of an e325 server and converts the KVM signal to standard CAT5 network cabling signals. An inexpensive CAT5 cable (with RJ-45 connectors on each end) then connects the first server to a UCO or a KCO (KVM Conversion Option, used by xSeries servers) in the next server in the rack. This allows customers to daisy-chain servers much like the C2T Interconnect feature. Because CAT5 cabling is industry-standard, customers can assemble cables to fit⁶ on-site. The UCO/KCO allows up to 16 servers to be chained together for common management. If customers have x330/x335 servers in the rack, there is a special 110mm (4") C2T Conversion Option (CCO) that takes the C2T output and converts it to CAT5 signals for input to one of the CAT5-based switches.

There are two CAT5-based console switches available to manage the servers via the UCO, KCO and CCO kits: Local Console Manager (LCM), a 4-port CAT5 console switch and Remote Console Manager (RCM), a 16-port switch. Each converts the CAT5 signals back to KVM signals for input to a management station.

Using the LCM, up to 16 servers can easily be daisy-chained together (using 16 KCOs) to each of its four CAT5 inputs, enabling the management of up to **64** servers. It provides a single user with local access over all connected systems. The RCM can handle up to **256** servers using any combination of UCO, KCO and CCO kits, and supports a single local user and up to two remote users simultaneously.

Both the LCM and the RCM can accept legacy KVM switch feeds by equipping the switch with one of the KCO options. This makes it easy to incorporate ACT into a traditional KVM environment. *The illustration below shows a sample ACT configuration:*



⁶ To achieve the highest video quality (1600x1280 resolution) for *local* management, the distance from the LCM or RCM to the *farthest* server on a chain should not exceed **15m (50 ft)**. For *remote* access at 1280x1024 resolution, total CAT5 cabling in any chain should be limited to about **10m (32 ft)**. Longer cables can be used, however video degradation is possible beyond these lengths. For more on ACT cabling, see the *ACT Decision Makers' Guide* at ibm.com/support/docview.wss?uid=psg1MIGR-46120.

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Like C2T Interconnect cabling, ACT reduces clutter, simplifies cable management, and reduces cabling costs. Also, having fewer cables improves rack airflow and reduces heat buildup. Plus, while typical KVM cabling limits the management to perhaps 16 servers per switch, ACT can support up to 256 servers using only one RCM. The reduced switch count means that more space is freed up in the side-pocket space of customers' racks; switch and PDU costs should be greatly reduced; server administration is simplified and there are fewer points of potential failure.

Variable Speed Fans

Eight strategically located fans provide effective system cooling for the e325, from front to back, throughout the system. This cooling scheme is important because newer, more powerful processors generate a significant amount of heat, and heat needs to be controlled for the system to function properly. The e325 has four system fans, one I/O fan and three fans integrated into the power supply.

The fans automatically adjust speeds in response to changing thermal requirements. When the temperature inside the server increases, the fans speed up to maintain the proper ambient temperature. When the temperature returns to a normal operating level, the fans return to their default speed. Why not simply run the fans at 100% capacity all the time? For several good reasons: to reduce the ambient noise, reduce the wear-and-tear on the fans and reduce the server power draw. The reduction in ambient noise and power draw may be relatively minor for a single server, but put dozens or hundreds in a data center and it makes a big difference!

Drive Bays

The e325 contains **three** bays. **Two** bays are **hot-swap**-capable (when used with SCSI hard disk drives). This enables up to two slim-line (1") 3.5" drives to be installed for a total **hot-swap Ultra320** SCSI disk capacity of **293.6GB**. (Two **fixed IDE** drives can be used instead, totaling up to **240GB**.) The bays accept drives that use the Converged Tray, for compatibility with other xSeries servers. A **24X⁷** speed IDE CD-ROM drive is standard in the other (ultraslim half-inch) bay. (DVD, CD-RW and DVD/CD-RW combo drives are available as options to replace the CD-ROM drive.) If a 1.44MB diskette drive is required, one is available as an option to attach externally to a USB port.

If the customer requires more than two 3.5" HDDs, an optional ServerAID SCSI controller, or an **IBM FASTt** Fibre Channel adapter can be installed, along with external storage units.

Extensive Systems Management Capabilities

The e325 has a high level of systems management capability, including an integrated systems management controller, Alert Standard Format, Automatic Server Restart, Wake-on-LAN support, PXE support, Predictive Failure Analysis, IBM Director and planned support for the optional Remote Supervisor Adapter II. This allows high levels of manageability for customers, without their having to purchase additional adapters or options.

The **integrated systems management controller** provides local and remote monitoring of the server, including the monitoring of system voltages, temperatures, fans, etc. It also controls the fan speed and the diagnostic LEDs. It features text console redirection over shared NIC or serial port, out-of-band LAN-based management, remote out-of-band alerts, support for command-line interface over shared NIC or serial port, remote access security, out-of-band environmental monitoring and alerting, secure remote power control and system reset over shared NIC or serial port, and others.

Alert Standard Format (ASF) firmware alerts IBM Director to anomalous environmental factors, such as voltage and thermal conditions—even if the server has failed.

Automatic Server Restart (ASR) helps reduce downtime by restarting the server automatically in the event of a system lockup. ASR technology is a combination of hardware circuitry tied into the server's system reset function and a device driver. As long as the server continues running, the ASR watchdog timer will keep being reset, but if the operating system crashes or the hardware freezes somehow the ASR software will be unable to reset the hardware timer. If the timer is not reset within five minutes, it automatically triggers the ASR hardware, which immediately restarts the server (and logs an ASR event with IBM Director). These features are designed to prevent *more than five minutes passing before the server is restarted*.

Wake on LAN permits the e325 to be remotely powered on if it has been shut off. Once powered up the server can be controlled across the network, using the **Preboot Execution Environment** (PXE 2.0).

⁷ Variable read rate. Actual playback speed varies and is often less than the maximum possible.

Outstanding 32/64-bit price/performance in a rack-dense 1U, 2-way server for HPC applications

Like Wake on LAN, PXE is system firmware. It allows systems management software to take control of a system before the BIOS, operating system or applications are loaded (using Wake on LAN/PXE) and lets an administrator perform many low-level tasks remotely that would otherwise require a visit to each system. These tasks may include such things as formatting a hard disk drive, updating system firmware (BIOS or ISMP, for example), or deploying a Windows or Linux operating system.

Predictive Failure Analysis (PFA) is designed to allow the e325 to detect impending failure of hard disk drives as much as 48 hours before actual failure, and alert the administrator through IBM Director. This helps give customers the ability to replace the failing component *before* it fails, resulting in increased uptime.

IBM Director 4.1x (planned for Q4/03), software for advanced workgroup management, is offered at no additional cost for the e325. IBM Director comes with a portfolio of tools for server management and increased availability. IBM Director provides a single uniform graphical interface for all systems management functions.

The combination of IBM Director and the integrated systems management controller enables the customer to customize thresholds and monitor system components (for things like temperature, voltage regulation, etc.) to help maximize uptime.

Plans call for the e325 to also support (**effective Q4/03**) an optional **Remote Supervisor Adapter II** for additional systems management capabilities, including:

- Web-based out-of-band control
- Windows "blue screen" capture
- Remote redirection of graphics, keyboard and mouse
- The ability to manage a rack of up to **24** servers from a single Ethernet or serial connection using one Remote Supervisor Adapter.

Note: This information represents IBM's current intentions, goals and objectives, and is subject to change or withdrawal without additional or prior notice.

Extensive System Support Features

The IBM services and technical support portfolio provides world-class, consistent, high-quality service and support. The e325 server offers a number of tools and services designed to make ownership a positive experience. From the start, IBM programs make it easier for customers to plan for, configure and purchase IBM @server systems, get them running and keep them running long-term. These programs and features include IBM ServerProven®, IBM Cluster Systems Management, the IBM @server xSeries and Netfinity Rack Configuration Tool, IBM ServerGuide™, Product Customization Services and extensive technical support offerings.

The IBM **ServerProven** program provides the confidence that specific options and operating systems have been tested on the e325 and are officially supported to work together. It is updated frequently with that the latest compatibility information.



IBM Cluster Systems Management (CSM) can help to reduce the total cost of ownership for cluster environments by streamlining and simplifying the management of large numbers of servers from a single point of control. This is of particular value in large data centers or for customers who are running complex high-performance workloads, where managers are constantly challenged to meet ever-changing business demands and improve service levels at the same time that IT budgets are shrinking. As customers evolve from using clusters for single-purpose workloads to employing cluster technology in grids or utility models, CSM can provide a path for growth and enhanced value.

Customers who have existing AIX-based cluster systems can leverage those skills to manage their Linux clusters. System administrators can automate problem determination and recovery, automate repetitive installation and configuration tasks, and monitor and report health information and resource utilization.

CSM is intended primarily for managing clusters of Linux-based xSeries servers or AIX-based pSeries™ servers, or for heterogeneous clusters combining the two, although it also works well with nonclustered Linux servers. Typically, customers would use IBM Director to manage all-Windows or a mix of Windows and Linux-based xSeries systems in a nonclustered environment. CSM would be the preferred choice for Linux-only nonclustered xSeries servers or clustered Linux/AIX systems (both xSeries and pSeries)—especially in a high-performance computing (HPC) environment.

IBM @server xSeries and Netfinity Rack Configurator is a downloadable tool that simplifies the often complex chore of configuring a full rack of e325, BladeCenter and xSeries servers and

Outstanding 32/64-bit price/performance in a rack-dense 1U, 2-way server for HPC applications

ensuring that customers have all the cables, power distribution units, KVM (keyboard, video and mouse) switch boxes and other components they need, as well as the proper airflow clearances, electrical circuits and other environmental conditions.

IBM **ServerGuide** (installed from CD) simplifies the process of installing and configuring e325 servers. ServerGuide goes beyond mere hardware configuration by assisting with the automated installation of the Windows 2000 and 32-bit Windows Server 2003 operating systems, device drivers and other system components, with minimal user intervention. (Selected drivers are also included for support of Novell NetWare, Red Hat Linux and SuSE Linux.) This focus on deployment helps customers reduce both their total cost of ownership and the complexity that administrators and technical personnel face.

Additional services include **hardware warranty upgrades** and factory-installed **Product Customization Services** (PCS), such as asset tagging, hardware integration, software imaging and operating systems personalization.

IBM offers extensive **technical support** by phone and via the Web. Support options include links to forums/newsgroups, problem submission, online shopping support, service offerings, device drivers for all IBM product lines, software downloads and even upcoming technical seminar worldwide schedules and registration. Also available are remote installation, configuration and usage support for both xSeries hardware and software, as well as onsite custom services to give customers the level of expertise they require.

Key Options

IBM options for @server systems let customers take their servers to a higher level

Make sure that customers know they can rely on @server options to supply a comprehensive solution for their business needs. Options help them create an optimized server system to meet their data protection, storage and availability needs. Every IBM option is designed and tested for peak performance and flexibility, helping to maximize the customer's return on investment. The combination of @server systems and options lets customers keep their fingers on the pulse of their e-business.

Processors — The AMD Opteron processor provides power, speed, a large cache, integrated memory controller and HyperTransport Technology. A 1MB L2 cache running at the full processor clock rate combined with an integrated memory controller results in reduced memory latency and speeds the movement of data through the processor and I/O devices. (**Note:** System performance depends not only on the number of processors in the server but also on the power and functionality of each processor.) Let customers know that adding a second processor may be a cost-effective way to achieve significant performance improvements. Unlike most processors, adding additional Opteron processors actually *increases* processor-to-memory bandwidth.

Memory — Memory is a significant factor in application performance. Adding more memory to a server is one of the most effective ways to increase application performance.

Hard Disk Drives — IBM hard disk drives help customers improve the transaction and cost performance of their servers. The choice of drives can be a critical aspect of maximizing the I/O throughput of the system. IBM Ultra320 SCSI hard disk drives are available for the e325 with capacities up to **73.4GB** at **15,000** RPMs and up to **146.8GB** at **10,000** RPMs. IDE (ATA-100) hard disk drives are available with capacities up to **120GB** at **7,200** RPMs.

ServeRAID Controllers — Servers using RAID technology allow companies to build a reliable foundation for business-critical computing. IBM ServeRAID technology allows an array consisting of multiple physical hard disk drives to be treated as one logical drive. ServeRAID technology also allows data to be stored redundantly, across multiple hard disk drives—enhancing both the integrity and the availability of the data. Optional ServeRAID controllers support **nine** RAID levels: **0** (striping), **00** (spans multiple arrays), **1** (mirroring), **10** (mirroring and striping), **1E** (enhanced mirroring, supporting odd numbers of drives), **1E0** (enhanced mirroring with striping), **5** (striping with parity), **50** (striping across multiple RAID 5 arrays) and **5EE** (enhanced RAID 5 with hot-spare drive). (**Note:** RAID 5EE is an improved version of RAID 5E, with up to **500-700%** faster array rebuild times.)

And because IBM ServeRAID controllers can help significantly improve data transfer rates, this technology is extremely effective when implementing demanding, transaction-oriented applications. By employing the advanced fault tolerance of IBM ServeRAID technology, companies can effectively implement networked business systems that require large amounts of storage space for data and applications that must be available for their businesses to continue operating.

The family of ServeRAID-4 (Ultra160) and ServeRAID-6 (Ultra320) SCSI controllers offers enhanced performance and the ability to add external storage capacity up to **4.1TB** (28 x

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146.8GB) using a **ServeRAID-6M** and **two IBM EXP300** Storage Expansion Units, with industry-leading ServeRAID Manager (RAID management) software.

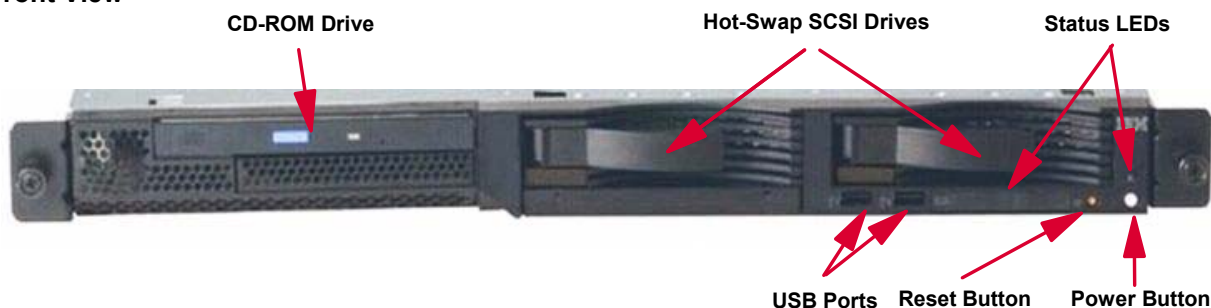
ATA-133 (IDE) RAID Controller — This two-channel, half-length PCI bus mastering controller supports ATA/133, ATA/100 and ATA/66 HDDs to create an economical, internal storage subsystem using popular RAID levels such as **RAID-0**, **RAID-1**, and **RAID-10**.

Fibre Array Storage Technology (FAStT) — IBM FAStT products are designed to support the large and growing data-storage requirements of business-critical applications. FAStT solutions for the e325 include the **FAStT200**, **FAStT200 HA**, **FAStT600**, **FAStT700** and **FAStT900** Storage Servers. Because IBM FAStT Fibre Channel solutions can support connectivity distances of up to **10km (6.2 miles)** at Fibre Channel rates of up to **2Gbps**, companies can more easily configure offsite servers and storage systems to keep critical data available around the clock—even in the event of a catastrophe.

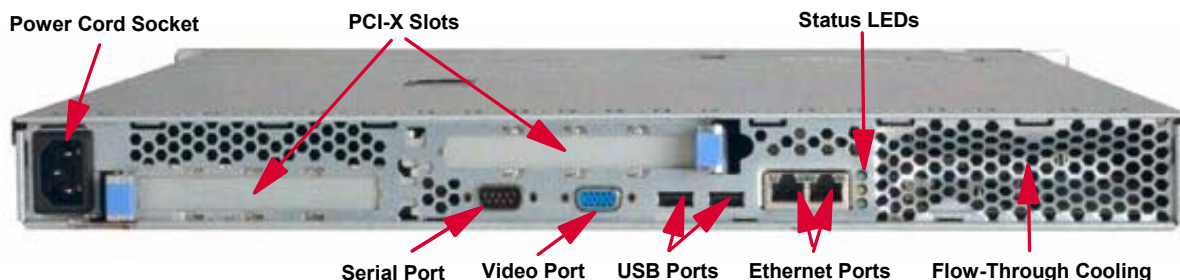
These storage servers are designed to provide highly-available Fibre Channel RAID protected storage that provide the foundation for Storage Area Networks (SANs). **FAStT900** storage servers deliver scalability up to **32.8TB**. They provide end-to-end Fibre Channel solutions with high-availability fault-tolerant components.

e325 Images

Front View

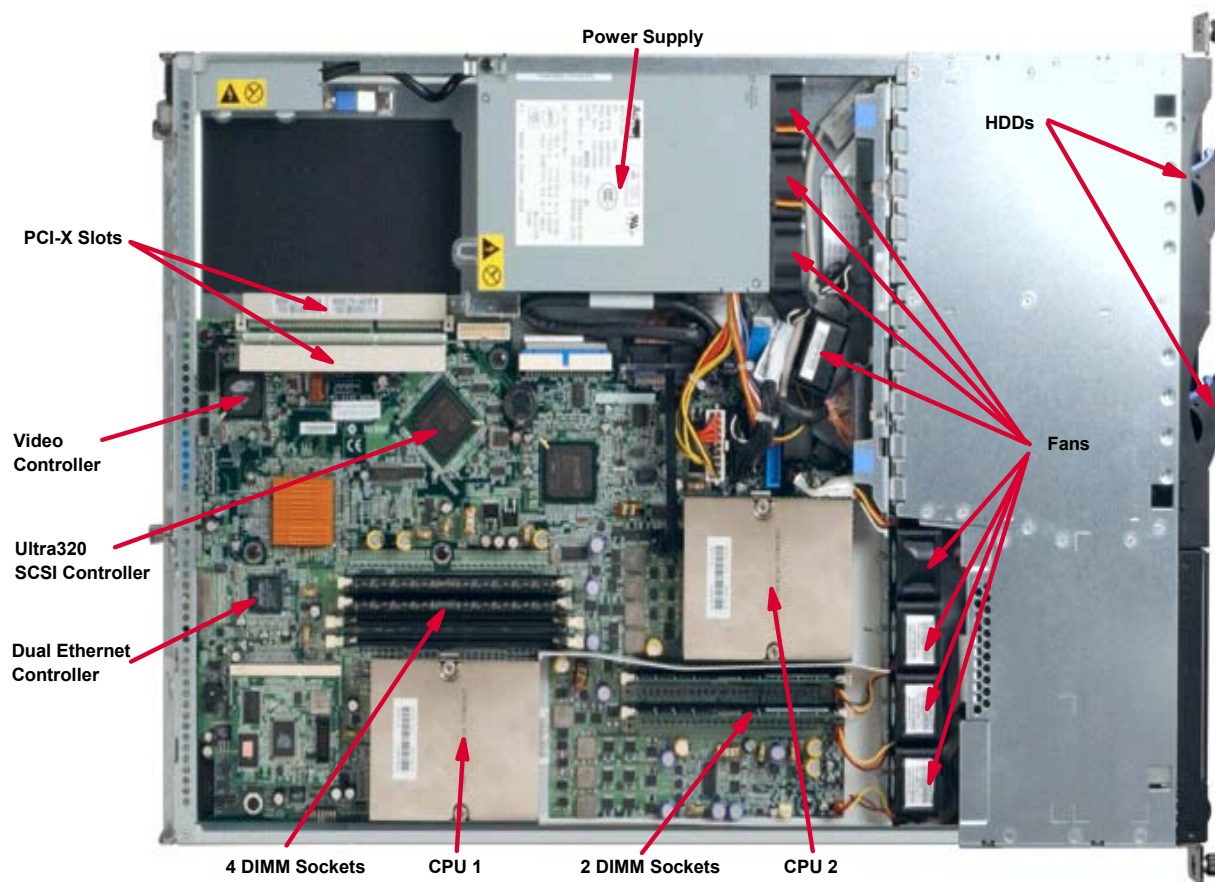


Rear View



Outstanding 32/64-bit price/performance in a rack-dense 1U, 2-way server for HPC applications

Inside View



e325 Specifications

e325 Specifications	
Machine type	8835-2xX, -3xX, -5xX
Form factor	1U
Processor type	AMD Opteron 240 (2xX models), 242 (3xX), 246 (5xX)
# of processor standard / maximum	1 / 2
Internal L2 cache	1MB, full-speed
Chipset	AMD-8000
Standard / maximum memory	1GB (2 x 512MB) / 12GB ⁸
Memory type	Registered PC2700 (333MHz) DDR Chipkill ECC
Memory interleaving	Two-way
DIMM capacities supported	512MB and 1GB (2GB planned)

⁸ Maximum memory and disk capacity may require the replacement of standard components with the largest supported component available. 12GB capacity requires a 2-way system using 2GB DIMMs. A uniprocessor system is limited to 8GB of RAM.

Outstanding 32/64-bit price/performance in a rack-dense 1U, 2-way server for HPC applications

e325 Specifications		
# of DIMM sockets total / available	6 ⁹ / 4	
# of drive bays total / available	3 / 3 (x1X models)	3 / 2 (x2X models)
# of 3.5" bays total / available	2 / 2	2 / 1 (HDD)
# of 5.25" bays total / available	1 / 0 (CD-ROM)	
Maximum 3.5" HDD capacity	293.6GB (2 x 146.8GB SCSI)	240GB (2 x 120GB IDE)
3.5" HDD capacities supported	36.4GB, 73.4GB, 146.8GB Ultra320 10K RPMs; 36.4GB, 73.4GB Ultra320 15K RPMs	40GB, 60GB, 80GB, 120GB IDE
# of HDDs standard	None (x1X models)	1 x 80GB IDE (x2X models)
# of CD-ROM drives standard	1 (24X ¹⁰ , in dedicated 5.25" bay)	
# of diskette drives standard	0 (external via USB port only)	
Internal tape drives supported	None	
Integrated SCSI technology	Hot-swap Ultra320	
HDD controller	Single-channel Ultra320 SCSI — LSI 53C1020	Dual-channel ATA-100
# of devices supported per channel	14	1
External SCSI devices supported natively	None	
Optional RAID controllers supported	ServeRAID-4Lx, -6M; ATA-133	
# of adapter slots total / available	2 / 2	
# of 64-bit / 133MHz PCI-X slots	None	
# of 64-bit / 100MHz PCI-X slots	2 (1 full-length, full-height; 1 half-length, low-profile)	
# of 32-bit / 33MHz PCI slots	None	
# of video ports	1	
Video controller	ATI Rage XL	
Video memory	8MB SDRAM	
Maximum video resolution	1600 x 1200 x 32-bit color at 66Hz 1600 x 1200 x 24-bit color at 85Hz	
Gigabit Ethernet controller	Dual Broadcom BCM5704	
# of Gigabit Ethernet ports	2 (rear)	
# of RS485 ports	None	
# of serial ports	1 (rear)	
# of parallel ports	None	
# of mouse ports	None (use USB mouse)	
# of keyboard ports	None (use USB keyboard)	
# of USB 1.1 ports	4 (2 front, 2 rear)	
Integrated systems management processor	Yes (QLogic)	

⁹ In a uniprocessor configuration, only 4 total DIMM sockets are available; to use all 6 sockets requires a 2-way configuration.

¹⁰ Variable read rate. Actual playback speed varies and is often less than the maximum possible.

Outstanding 32/64-bit price/performance in a rack-dense 1U, 2-way server for HPC applications

e325 Specifications		
Optional systems management adapter	Remote Supervisor Adapter II (support planned for Q4/03)	
Light path diagnostics	No (diagnostic LEDs only)	
Predictive Failure Analysis support	Hard disk drives	
Power supply size	411W	
# of power supplies standard / maximum	1 / 1	
# of fans/blowers standard / maximum	8 / 8 variable speed	
Dimensions (HWD) / weight	1.7" (43mm) H 17.3" (440mm) W 26" (660mm) D	26 - 28.4 lb 11.8 - 12.9 kg
Operating systems supported	Windows Server 2003 (Standard/Web/Enterprise Editions), Red Hat Enterprise Linux Advanced Server 2.1, SuSE Linux Professional 8.2, SuSE Enterprise Server (SLES) 8.0 (64-bit)	
Length of limited onsite warranty	1 year (parts and labor) ¹¹ , upgradable to 3/3.	

Selling Features

Power and Scalability

As your customer's business changes and grows, the e325 has the ability to grow with the customer's requirements, thanks to:

- Up to two **Opteron 246** processors with **two-way** SMP capability, HyperTransport technology and 1MB of integrated Level 2 cache per processor, to offer outstanding performance capable of tackling the toughest jobs.
- Up to **12GB** of high-speed dual data rate (**DDR**) **Chipkill** error checking and correcting (**ECC**) system memory, if the customer needs to add more users or another application.
- Two available **64-bit 100MHz PCI-X** slots help to provide protection from technological obsolescence, by supporting future high-speed PCI-X adapters (such as **10Gb** Ethernet and **10X** InfiniBand) that won't run in older 33MHz and 66MHz PCI slots.
- A high degree of integration that saves valuable adapter slots — **Dual Gigabit Ethernet** controllers provide high-speed network communications; an **Ultra320** SCSI controller offers **RAID-1** mirroring standard; the **integrated systems management controller** performs sophisticated systems management; and an ATI **Rage XL** video chip provides high-performance graphics.
- Up to **two** hard disk drives, which provide either: up to **293.6GB** of internal **Ultra320** SCSI **hot-swap** storage for the operating system and applications, and allow for a **RAID-1** mirrored array; or up to **240GB** of fixed **IDE/ATA-100** storage.
- Up to terabytes of external storage, via optional ServeRAID or FASTT controllers.

Control

- **IBM Director 4.1x** (planned for **Q4/03**) is included for proactive systems management. It comes with a portfolio of tools, including Management Processor Assistant, RAID Manager, Update Assistant, BladeCenter Deployment Wizard and a Real Time Diagnostics tool. In addition, IBM Director offers extended systems management tools as part of the optional **IBM Director Server Plus Pack**, including Capacity Manager, System Availability, Rack Manager, Active PCI Manager and Software Rejuvenation, for additional server management and increased availability.
- **Cluster Systems Management (CSM) 1.3.x** is available for enhanced control of Linux clusters.

¹¹ For terms and conditions or copies of the IBM Statement of Limited Warranty, call 800-772-2227 in the U.S. In Canada call 800-426-2255. Telephone support may be subject to additional charges. For warranties including onsite labor, a technician is sent after IBM attempts to resolve the problem remotely. International warranty service is available in any country in which this product is sold.

Outstanding 32/64-bit price/performance in a rack-dense 1U, 2-way server for HPC applications

- Optional **ACT** interconnect cabling technology can eliminate hundreds of connectors and hundreds of feet of KVM cables per rack, while helping to increase reliability and reduce setup time. This saves customers money in terms of KVM cabling, PDUs and KVM switches, as well as the time necessary to manage all those cables switches. The **1U** form factor allows the customer to pack a lot of power in a small data center, while minimizing the floor space cost for all those servers.
- The **integrated systems management controller** sends hardware alerts to IBM Director, which in turn notifies the administrator of potential issues.
- Integrated systems management controllers can be linked among systems for multiserver control, using an optional **Remote Supervisor Adapter II**. These adapters allow 24 servers to be controlled remotely from one console.

Service

- **Chipkill** memory is up to **16X¹²** better than standard ECC memory at correcting memory errors, which should reduce the downtime due to memory failures.
- The **one-year** (parts and labor) limited **onsite warranty¹³** (upgradable to three years) gives your customers peace of mind and greater investment protection.
- **Toolless**, cover removal provides easy access to upgrades and serviceable parts. This means less time (and therefore less money) spent servicing the e325. Toolless rails allow e325 servers to be installed more quickly and easily. Similarly, **hot-swap, redundant** HDDs mean greater system uptime while these components are being serviced.
- The **integrated systems management controller** provides local systems management, as well as remote support via a Remote Supervisor Adapter. The integrated systems management controller, which works with IBM Director to help increase system availability for users, enables IBM service personnel to use sophisticated diagnostic tools to resolve problems quickly.

Easy Configurator¹⁴



e325 Models

1.4GHz, Opteron 240, 1GB DDR RAM, open bay H/S SCSI	8835-21X
1.4GHz, Opteron 240, 1GB DDR RAM, 80GB IDE	8835-22X
1.6GHz, Opteron 242, 1GB DDR RAM, open bay H/S SCSI	8835-31X
1.6GHz, Opteron 242, 1GB DDR RAM, 80GB IDE	8835-32X
2.0GHz, Opteron 246, 1GB DDR RAM, open bay H/S SCSI	8835-51X
2.0GHz, Opteron 246, 1GB DDR RAM, 80GB IDE	8835-52X

Processor Upgrades

1.4GHz, Opteron 240, 1MB cache	24P8189
1.6GHz, Opteron 242, 1MB cache	24P8190
2.0GHz, Opteron 246, 1MB cache	13N0700

Memory Upgrades

512MB PC2700 CL2.5 ECC DDR SDRAM RDIMM (256Mb)	73P2266
1GB PC2700 CL2.5 ECC DDR SDRAM RDIMM (256Mb)	73P2267
2GB PC2700 CL2.5 ECC DDR SDRAM RDIMM (512Mb)	(Planned)

¹² Chipkill memory is designed to detect and correct single and multibit errors, helping lead to improvements in reliability up to 16 times that of standard ECC technology. Reliability improvements depend on many factors and may be less than the maximum stated.

¹³ For terms and conditions or copies of the IBM Statement of Limited Warranty, call 800-772-2227 in the U.S. In Canada call 800-426-2255. Telephone support may be subject to additional charges. For warranties including onsite labor, a technician is sent after IBM attempts to resolve the problem remotely. International warranty service is available in any country in which this product is sold.

¹⁴ The easy configurator lists selected options and upgrades for this server. For the complete list of supported features, go to the IBM ServerProven Web page at <http://ibm.com/pc/us/compat>. For configuration assistance, see the xSeries Configuration and Options Guide at <http://ibm.com/pc/qtechinfo/SCOD-3ZVQ5W.html>.

Outstanding 32/64-bit price/performance in a rack-dense 1U, 2-way server for HPC applications



Internal Storage: Hard Disk Drives

36.4GB	15,000rpm	Ultra320 SCSI non-hot-swap	32P0784
73.4GB	15,000rpm	Ultra320 SCSI non-hot-swap	32P0785
36.4GB	10,000rpm	Ultra320 SCSI hot-swap	32P0726
36.4GB	15,000rpm	Ultra320 SCSI hot-swap	32P0734
73.4GB	10,000rpm	Ultra320 SCSI hot-swap	32P0727
73.4GB	15,000rpm	Ultra320 SCSI hot-swap	32P0735
146.8GB	10,000rpm	Ultra320 SCSI hot-swap	32P0728
40GB	7,200rpm	EIDE AT/100	22P7157
60GB	7,200rpm	EIDE AT/100	09N4207
80GB	7,200rpm	EIDE AT/100	09N4226
120GB	7,200rpm	EIDE AT/100	09N4231



SCSI / IDE Controllers

ServeRAID-4Lx — Ultra160, 1-channel, 32MB cache	06P5740
ServeRAID-6M — Ultra320, 2-channel, 128MB battery-backed cache	33P0033
ServeRAID-6M — Ultra320, 2-channel, 256MB battery-backed cache	02R0988
PCI Ultra320 SCSI Controller — 1-channel (non-RAID)	71P8594
ATA-133 RAID Controller — ATA-133, ATA-100, ATA-66, 2-channel, half-length	71P8592



Rack Options

NetBAY11 Standard Rack Cabinet	9306110
NetBAY25 Standard Rack Cabinet	9306250
NetBAY42 Standard Rack Cabinet	9306420
NetBAY42 Standard Expansion Rack Cabinet	9306421
NetBAY42 Enterprise Expansion Rack Cabinet	930842S
NetBAY42 Enterprise Expansion Rack Cabinet (EX)	930842E
NetBAY 1U Flat Panel Monitor Console Kit	32P1032
NetBAY 1U Flat Panel Monitor Console Kit with US Keyboard	32P1031
NetBAY 2U Flat Panel Monitor Console Kit	32P1703
NetBAY 2U Flat Panel Monitor Console Kit with US Keyboard	32P1702
T541 Flat Panel Monitor (15")	9512AB1
E54 Color Monitor (15")	633147N
E74 Color Monitor (17")	63324HN
G78 Color Monitor (17")	66274AN



Network Interface Cards (NICs)

IBM Gigabit Ethernet SX Server Adapter	06P3701
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Systems Management

Remote Supervisor Adapter II	(Support planned for Q4/03)	59P2984
1.5m ACT USB Conversion Option (UCO) cable		73P5832
ACT Local Console Manager		1735L04
ACT Remote Console Manager		1735R16

Outstanding 32/64-bit price/performance in a rack-dense 1U, 2-way server for HPC applications



External Storage

EXP300 Ultra160 SCSI Storage Expansion Unit	35311RU
TotalStorage FASTT FC2/133 Host Adapter	24P0960
TotalStorage FASTT200 Storage Server	35421RU
TotalStorage FASTT200 HA Storage Server	35422RU
TotalStorage FASTT600 Storage Server	172260U
TotalStorage FASTT700/FASTT900 Mini Hub	19K1269
TotalStorage FASTT700 Storage Server	17421RU
TotalStorage FASTT EXP500 Expansion Unit	35601RU
TotalStorage FASTT EXP700 Expansion Unit	17401RU

Miscellaneous

USB 1.44 Floppy Disk Drive	05K9276
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Product Positioning

e325 vs. x335, x382 and p615

Each system offers advantages over the others, depending on the environment.

The Bottom Line

1. Choose **e325 (Opteron)** for high **64-bit** Linux/Windows price/performance. Choose **x382 (Itanium 2)** for the highest **64-bit floating point** Windows performance. Choose **p615 (IBM POWER4+)** for the highest **64-bit floating point** performance on Linux/UNIX® (IBM AIX 5L).
2. Choose **e325** for the best **32-bit** price/performance. Choose **x335 (Xeon)** for the lowest-cost **32-bit** solution.
3. Choose **e325** for the lowest-cost **64-bit** solution. Choose **p615** for the most scalable **64-bit** solution.
4. Choose **e325** or **x335** for the greatest rack density (**1U**). Choose **p615** for the most On Demand features.
5. Choose **x382** for the most high-availability features for Windows. Choose **p615** for the most RAS features overall.
6. Choose **x382** for the most total memory (**16GB**) for Windows. Choose **p615** for the most PCI-X slots (**6**) for Linux/UNIX.
7. Choose **e325** for the most cost-effective 32-bit to 64-bit **migration** path. Choose **x335** or **x382** for an **Intel-only shop**. Choose **p615** for system partitioning.
8. Choose **p615** for the most stable **64-bit OS** and the most 64-bit applications. Choose **x382** for the most 64-bit Windows applications.
9. Choose **e325** or **x335** for an IBM @server **Cluster 1350** implementation. Choose **p615** for a **Cluster 1600** environment.

Competitive Analysis¹⁵ HP Integrity rx2600

e325: The e325 with the Opteron processor can support a peak **HyperTransport Tunnel** bandwidth of **16.0GB** per second, up to **250% better** than that of the Itanium 2.

Integrity rx2600: The peak front side bus (FSB) bandwidth of the Itanium 2 is **6.4GBps** in a system with a **400MHz** FSB.

e325: Full processor clock rate memory access, due to the memory controller integrated into the Opteron processor.

¹⁵ Data on competitive products is obtained from publicly available information and is subject to change without notice. The information is current as of August 4, 2003. For the most recent information, visit <http://hp.com>, <http://dell.com>, <http://intel.com> and <http://amd.com>.

Outstanding 32/64-bit price/performance in a rack-dense 1U, 2-way server for HPC applications

Integrity rx2600: Itanium 2 accesses memory at the FSB speed (**400MHz**, currently).

e325: Supports **333MHz PC2700** DDR ECC memory with higher performance than PC2100 memory.

Integrity rx2600: Supports only **266MHz PC2100** DDR ECC memory.

e325: The e325 with the Opteron processor can support a peak aggregate **memory** bandwidth of **10.6GB** per second in a 2-way configuration, up to **25% better** than that of the Itanium 2.

Integrity rx2600: The peak aggregate memory bandwidth of the Itanium 2 is **8.53GB** per second in a system with a **400MHz** FSB.

e325: The e325, with the **64-bit** Opteron processor, is capable of running either 32-bit or 64-bit software natively, or both at once, at high performance.

Integrity rx2600: Using the 64-bit Xeon processor, the rx2600 is limited to only 64-bit software at high-speed. 32-bit software runs in emulation mode and therefore much slower than the clock rate would indicate.

e325: The Opteron processor can support a peak aggregate **I/O** bandwidth of **12.8GB** per second in a 2-way **2.0GHz** configuration, **100% better** than that of the Itanium 2.

Integrity rx2600: The peak aggregate I/O bandwidth of the Itanium 2 is **6.4GB** per second in a system with a **400MHz** FSB.

e325: Models available with either low-cost **IDE/ATA** or high-performance **Ultra320 SCSI** drives.

Integrity rx2600: Offers only SCSI models.

e325: The **1U** form factor means **twice** as many servers per rack as the rx2600, and lower data center floor-space costs in large numbers.

Integrity rx2600: The **2U** form factor requires more racks in large quantities.

e325: Includes **dual integrated Gigabit Ethernet** controllers for high performance without using any adapter slots.

Integrity rx2600: Includes only **one Gb Ethernet** controller and **one 10/100Mbps** controller. Dual Gb requires an *extra-cost* option and consumes one of the adapter slots.

e325: The shallower depth of the e325 (**66cm/26"**) simplifies rack cable management and serviceability.

Integrity rx2600: The rx2600 at **68.6cm/26.5"** is nearly **an inch deeper** than the e325.

e325: The e325 offers optional ACT cabling technology. This dramatically simplifies the cabling of rack-mounted servers and eliminates the need for potentially hundreds of KVM cables per rack of 1U servers and associated PDUs and KVM switches. This can save the customer as much as thousands of dollars per rack over standard KVM cabling, as well as significant administration time. Also, the interconnection can be done without opening the chassis, and a server can be taken offline without changing the wiring.

Integrity rx2600: HP offers a solution that requires an adapter in every rx2600, at a higher cost than the IBM ACT solution. It also requires opening every server to install the adapter, and rewiring the cabling whenever a server is taken offline—which can be a much more time-consuming process.

e325: Offers **superior integer** performance and **most of the floating point** performance¹⁶ of the rx2600 at a *fraction* of the price. **Price/performance** is tremendously better.

Integrity rx2600: The price is several **times** higher than for the e325 for similarly configured systems.

The Bottom Line

1. Sell **speed**: **Faster memory and front-side bus** helps your customers power through the toughest jobs. **Integer performance** is better than that of the rx2600. FP performance is about 20% lower, but at a **much, much lower price**.
2. Sell **ACT cabling technology**: It dramatically simplifies rack KVM cabling and reduces connectors, thereby helping to increase manageability and serviceability and reducing cabling cost and administration time.

¹⁶ HP DL360 results: <http://www.spec.org/cpu2000/results/res2003q3/cpu2000-20030630-02353.html> HP rx2600 results: <http://www.spec.org/cpu2000/results/res2003q3/cpu2000-20030630-02322.html> IBM @server 325 results will be available as of August 11, 2003. Price comparisons using public web prices as of July 28, 2003.

3. Sell cost: Dramatically **lower system price**, plus the option of **IDE** or **SCSI** drives make the e325 a tremendous price/performer vs. the rx2600. **Half the rack space required** means fewer racks are required when large numbers of servers are involved, and less data center floor space.

Dell PowerEdge 1750

e325: The e325 with the Opteron processor can support a peak **HyperTransport Tunnel** bandwidth of **16.0GB** per second, **375% better** than that of Xeon.

PowerEdge 1750: The peak FSB bandwidth of Xeon is **4.26GBps** in a system with a **533MHz** FSB.

e325: Full-speed memory access (**1.4GHz-2.0GHz**, currently, depending on the model), due to the memory controller integrated into the Opteron processor.

PowerEdge 1750: Xeon accesses memory at the FSB speed (**400MHz** or **533MHz**, currently).

e325: Supports **333MHz PC2700** DDR ECC memory with higher performance than PC2100 memory.

PowerEdge 1750: Supports only up to **266MHz PC2100** DDR ECC memory.

e325: The Opteron processor can support a peak aggregate **memory** bandwidth of **10.6GB** per second in a 2-way configuration, up to **2.5X** that of Xeon.

PowerEdge 1750: The peak aggregate memory bandwidth is **4.26GBps** in a system with a **533MHz** FSB.

e325: Supports up to **12GB¹⁷** of memory, **50% more** than the Dell.

PowerEdge 1750: Supports up to **8GB** of RAM.

e325: The e325, with the **64-bit** Opteron processor, is capable of running either 32-bit or 64-bit software, or both at once.

PowerEdge 1750: Using the 32-bit Xeon processor, the PE 1750 is limited to only 32-bit software.

e325: Offers integrated **RAID-1** mirroring, standard.

PowerEdge 1750: An *extra-cost* card is required for RAID-1 support.

e325: The Opteron processor can support a peak aggregate **I/O** bandwidth of **12.8GB** per second in a 2-way **2.0GHz** configuration, **4 times** that of Xeon.

PowerEdge 1750: The peak aggregate I/O bandwidth is **3.2GB** per second.

e325: Provides integrated systems management functionality for remote management monitoring.

PowerEdge 1750: Requires an *extra-cost* ERA/O card for equivalent systems management capabilities.

e325: Models available with either low-cost **IDE/ATA** or high-performance **Ultra320 SCSI** drives.

PowerEdge 1750: Offers only SCSI models.

e325: The shallower depth of the e325 (**65cm/25.6"**) simplifies rack cable management and serviceability.

PowerEdge 1750: The PE 1750 at **68.6cm/27"** is nearly **6% deeper** than the e325.

e325: The e325 offers optional ACT cabling technology. This dramatically simplifies the cabling of rack-mounted servers and eliminates the need for up to hundreds of KVM cables per rack of 1U servers and associated PDUs and KVM switches. This can save the customer as much as thousands of dollars per rack over standard KVM cabling, as well as significant administration time. Also, the interconnection can be done without opening the chassis, and a server can be taken offline without changing the wiring.

PowerEdge 1750: Dell offers nothing equivalent to ACT. The administrator must install many KVM cables, switches and PDUs for a rack full of PE 1750 servers. Whenever a server is taken offline the remaining servers must be rewired—a time-consuming process.

¹⁷ 12GB capacity requires a 2-way system using 2GB DIMMs. A uniprocessor system is limited to 8GB of RAM.

Outstanding 32/64-bit price/performance in a rack-dense 1U, 2-way server for HPC applications

The Bottom Line

1. Sell speed: Faster memory and front-side bus helps your customers power through the toughest jobs. Twice the L2 processor cache improves processor performance.
2. Sell expandability: More total memory and **RAID-1** mirroring standard. It can be upgraded to an optional **Remote Supervisor Adapter II** for greater systems management functionality. Sell flexibility: Choice of **IDE** or **SCSI** drives.
3. Sell **ACT** cabling technology: It dramatically simplifies rack KVM cabling and reduces connectors, thereby helping to increase manageability and serviceability and reducing cabling cost and administration time.
4. Sell systems management: The e325 can manage dozens of servers from one **Remote Supervisor Adapter** via serial or Ethernet cabling. The shallower chassis depth simplifies servicing and cable management, as well as allowing better airflow and cooling.



For More Information

IBM @server e325	ibm.com/pc/us/eserver/opteron/index.html
IBM @server xSeries	ibm.com/pc/ww/eserver/xseries
ACT Decision Makers' Guide	ibm.com/support/docview.wss?uid=psg1MIGR-46120
Competitive Sales Tool	w3.ibm.com/sales/systems/ibmsm.nsf/MainFrameset?OpenForm&cdoc=xscst
Customer References	w3.ncs.ibm.com/materials
Rack Configurator	ibm.com/pc/us/eserver/xseries/library/configtools.html
ServerProven Program	ibm.com/pc/us/compat
Technical Support	ibm.com/server/support
Other Technical Support Resources	ibm.com/servers/eserver/techsupport.html
xSeries Configuration and Options Guide	ibm.com/pc/qtechinfo/SCOD-3ZVQ5W.html
xSeries Options	ibm.com/pc/us/eserver/xseries/storage.html
xSeries Systems Management Sales Kit	w3.ibm.com/sales/systems/ibmsm.nsf/docnames/xsysmgmtsk

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